Proposed Plan

Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead

Prepared for NOAA Fisheries by the Lower Columbia River Estuary Partnership

November 5, 2007

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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NOTE TO READERS:

This proposed *Columbia River Estuary Recovery Plan Module* will be the basis of estuary recovery actions for Endangered Species Act-listed salmon and steelhead in the Columbia River Basin. The module will be incorporated by reference into recovery plans for listed Columbia Basin salmon evolutionarily significant units (ESUs) and steelhead distinct population segments (DPSs). It is important to have a unified set of actions for the Columbia River estuary to address the needs of all listed Columbia Basin ESUs and DPSs.

This proposed *Columbia River Estuary Recovery Plan Module* was prepared by the Lower Columbia River Estuary Partnership under contract to NOAA Fisheries.

DISCLAIMER:

Recovery plans delineate such reasonable actions as may be necessary, based upon the best scientific and commercial data available, for the conservation and survival of listed species. Plans are published by the National Marine Fisheries Service (NMFS), sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Nothing in this Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than the National Marine Fisheries Service. They represent the official position of the National Marine Fisheries Service only after they have been signed by the Assistant Administrator. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

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Acronyms

BiOp	Biological Opinion
BMPs	best management practices
cfs	cubic feet per second
CRE	Columbia River estuary
CSMEP	Collaborative Systemwide Monitoring and Evaluation Project
DDT	dichlorodiphenyltricholoroethane
DPS	distinct population segment
EDT	Ecosystem Diagnosis and Treatment
ENSO	El Niño/Southern Oscillation
ESA	Endangered Species Act
ERME	estuary research, monitoring, and evaluation
ESU	evolutionarily significant unit
ETM	estuarine turbidity maximum
FCRPS	Federal Columbia River Power System
GIS	geographic information system
HUC	hydrologic unit code
ISAP	Independent Science Advisory Panel
ISRP	Independent Science Review Panel
LCFRB	Lower Columbia Fish Recovery Board
LCRANS	Lower Columbia River Aquatic Nonindigenous Species Survey
LCREP	Lower Columbia River Estuary Partnership
LIDAR	Light Detection and Ranging
MR&E	monitoring, research, and evaluation
NASQAN	National Stream Quality Accounting Network
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDO	Pacific Decadel Oscillation
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
RM	river mile
WDF	Washington Department of Fisheries

Glossary

Accretion: The accumulation of sediment deposited by natural fluid flow processes.

Alevins: Salmonids at the life stage between egg and fry.

Amphipods: Benthic invertebrates, particularly the amphipod *Corophium salmonis,* which is found in intertidal and shallow subtidal habitats of the Columbia River estuary and is seasonally important in the diet of juvenile salmonids.

Ancient marshes: Marshes formed between 6,000 and 10,000 years ago.

Bar: A ridge or succession of ridges of sand or other substances, especially a formation extending across the mouth of a river or harbor that may obstruct navigation.

Bathymetry: The measure of the depths of oceans, seas, or other large bodies of water.

Beach erosion: The carrying away of beach materials by wave action, tidal currents, littoral currents, or wind.

Beach nourishment: The process of replenishing a beach by artificial means, such as through deposition of dredged materials; also called beach replenishment or beach feeding.

Bedload: Sand that rolls and bounces along the surface of the riverbed, usually downstream, although there may be a small displacement toward deeper water caused by the side slopes of the riverbed. In sandy riverbeds, bedload transport shapes the bed into a series of sand waves.

Beneficial use: Placement or use of dredged material for some productive purpose; either the dredged material or the placement site may be the integral component of the beneficial use.

Benthic: Of or relating to the bottom of a body of water, particularly the ocean.

Buffer area: A parcel or strip of land that is designed and designated to permanently remain vegetated in an undisturbed and natural condition to protect an adjacent aquatic or wetland site from upland impacts, to provide habitat for wildlife.

Centennial marshes: Marshes formed over the last century.

Continental shelf: The zone bordering a continent extending from the line of permanent immersion to the depth (usually about 100 to 200 meters) at which there is a marked or steep descent toward greater depths.

Delta: An alluvial deposit, usually triangular, at the mouth of a river. It is normally built up only where there is no tidal or current action capable of removing the sediment as fast as it is deposited.

Deposition: The deposit of sediment in an area through natural means, such as wave action or currents, or mechanical means.

Detritus: A loose mixture of organic material (dead plants and animals) and inorganic material (rock fragments) that results directly from disintegration of the material.

Dikes: Earthen walls constructed to contain water; sometimes constructed around dredged material disposal sites but more commonly constructed as flood protection.

Dredging: The removal or redistribution of sediments from a watercourse.

Ecosystem: A community of organisms in a given area together with their physical environment and its characteristic climate.

El Niño/Southern Oscillation: A shorter term climate effect that alternates between cold and warm phases approximately every 3 to 7 years; is associated with a warm-water current that periodically flows southward along the coast of Ecuador, and the southern oscillation in the atmosphere; affects climatic and ocean conditions throughout the Pacific region.

Emergent marsh: A wet, springy peatland that occurs along the edges of lakes and streams and is covered by grass-like sedges and fed by minerals washing in from surrounding lands.

Emergent vegetation: Rooted plants that can tolerate some inundation by water and that extend photosynthesis parts above the water surface for at least part of the year; emergent vegetation is intolerant of complete inundation over prolonged periods.

Estuarine turbidity maximum (ETM): A circulation phenomenon in an estuary that traps particles and promotes biochemical, microbial, and ecological processes that sustain an important pathway in the estuary's food web.

Estuary: A semi-enclosed coastal body of water with a free connection to the open ocean in which sea water is diluted with runoff from the land.

Exotic species: A non-native plant or animal deliberately or accidentally introduced into a habitat.

Fill: Sand, sediment, or other earth materials that are placed, deposited, or stockpiled.

Fingerling: A juvenile salmonid less than 1 year old.

Floodplain: A flat tract of land bordering a river, mainly in its lower reaches, and consisting of alluvium deposited by the river during flooding.

Fluvial: Involving running water; usually pertains to stream processes.

Forested wetlands: Wetlands that occur in palustrine and estuarine areas and possess an over story of trees, an understory of young trees or shrubs, and a herbaceous layer.

Freshet: High stream flow caused by rains or snowmelt and resulting in the sudden influx of a large volume of freshwater in the estuary.

Fresh water: Water that is less than 0.5 part salt per thousand.

Fry: Juvenile salmonids that have absorbed their egg sac.

Genetic diversity: Variation at the level of individual genes (polymorphism); provides a mechanism for populations to adapt to their ever-changing environment.

Habitat: The physical, biological, and chemical characteristics of a specific unit of the environment occupied by a specific plant or animal; the place where an organism naturally lives.

Habitat capacity: A category of habitat assessment metrics, including "habitat attributes that promote juvenile salmon production through conditions that promote foraging, growth, and growth efficiency, and/or decreased mortality" (Fresh et al. 2005).

Habitat connectivity: A measure of how connected or spatially continuous habitats occur in a larger ecosystem.

Habitat opportunity: A category of habitat assessment metrics that evaluate the capability of juvenile salmon to access and benefit from the habitat's capacity (Fresh et al. 2005).

High marsh: A wetland ecosystem influenced by a marsh surface elevation at approximately mean higher high water that is inundated by only the most extreme high tides and is characterized by salt-tolerant emergent vegetation.

Intertidal: Of or relating to the substrate that is exposed and flooded by tides; includes the associated splash zone.

In-water disposal: Placement of dredged material along the riverbed in or adjacent to the navigational channel or in designated in-water sites; commonly referred to as flow-lane disposal.

Limiting factor: Physical, chemical, or biological features that impede species and their independent populations from reaching viability status.

Littoral: Of, relating to, or situated or growing on or near a shore; especially of the sea.

Littoral current: A current running parallel to the beach and generally caused by waves striking the shore at an angle.

Low marsh: A wetland ecosystem characterized by salt-tolerant emergent

vegetation and twice-daily inundation of high tides.

Macroinvertebrates: Invertebrates that are of visible size, such as clams and worms.

Marsh: An area of soft, wet, or periodically inundated land, generally treeless and usually characterized by grasses and other low growth.

Mean high water: The average height of all high waters over 19 years.

Mean higher high water: The average height of the higher of two unequal daily high tides over 19 years.

Mean low water: The average height of all low waters over 19 years.

Mean lower low water: The average height of the lower of two unequal daily low tides over 19 years.

Macrodetritus: Dead or dying matter from a plant or animal that is visible to the unaided eye; usually larger than 1 to 2 mm in diameter.

Microdetritus: Dead or dying matter from a plant or animal; usually smaller than 1 to 2 mm in diameter.

Navigational channels: Channels in estuaries and other water bodies that are created, deepened, and maintained by dredging to enable vessels to navigate safely between, into and out of ports, harbors, and marinas without running aground.

Nearshore: An indefinite zone extending seaward from the shoreline well beyond the breaker zone.

Ocean-type: Of or relating to salmonid juveniles that enter the estuary as fry or fingerlings and stay in the estuary for weeks or months before entering the ocean; examples are chum and subyearling chinook.

Oligohaline: Of or relating to water having low salinity.

Overbank flooding: Out-of-bank flooding resulting from flow events that exceed the bankfull.

Over-water structures: Human-made structures, such as a pier, that extend over all or part of the surface of a body of water.

Pacific Decadel Oscillation: A longer term climate effect that alternates between cold and warm phases approximately every 30 years.

Pelagic: Pertaining to the open ocean.

Pinnipeds: Seals, sea lions, and walruses that belong to the taxonomic suborder called Pinnipedia, or the "fin-footed." Pinnipeds are carnivorous aquatic mammals that use flippers for movement on land and in the water. The pinnipeds referred to in this document are Pacific harbor seals, California sea lions, and Stellar sea lions.

Pier: A structure, usually of open construction, extending out into the water from the shore, to serve as a landing place, recreational facility, etc., rather than to afford coastal protection.

Piling: A long, heavy timber or section of concrete or metal that is driven into the earth or bottom of a water body to serve as a structural support or protection.

Pile dike: Two parallel rows of piling that are tied together and extend 300 to 500 feet into the river.

Pile dike field: Several pile dikes spaced about 1,200 to 1,500 feet apart, typically built to concentrate flow and stabilize the channel; within the dike field, current velocities are slowed and flow is deflected away from the river bank.

Plume: The layer of Columbia River water in the nearshore Pacific Ocean.

Polychlorinated biphenyls (PCBs): A group of synthetic, toxic industrial chemical compounds that are chemically inert and not biodegradable; they once were used in making paint and electrical transformers.

Polycyclic aromatic hydrocarbons (PAHs): A group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat.

Population: A distinct breeding unit of a species that exhibits similar life history strategies.

Redds: Spawning nests used by trout and salmon.

Revetment: A facing of stone, concrete, etc., to protect an embankment or shore structure from erosion by wave action or currents.

Salmonid population viability: Measure of the status of anadromous salmonids that uses four performance criteria: abundance, productivity, spatial distribution, and diversity.

Salmonid: Any member of the family Salmonidae, which includes the salmon, trout, char, whitefishes, and grayling of North America.

Sand: An unconsolidated mixture of inorganic soil (possibly including disintegrated shells and coral) consisting of small but easily distinguishable grains ranging in size from about 0.062 mm to 2.0 mm.

Sand waves: Waves of sand on the bottom of a riverbed that move in response to river discharge and bedload transport. In the Columbia, sand waves cover the riverbed and are typically 4 to 8 feet high and 300 to 400 feet long. When the river discharge is less than 300,000 cfs, sand waves move only a few feet per day; however, when discharge exceeds 400,000 cfs, sand wave movement can reach 20 feet per day or more.

Scour: The removal of underwater material by waves and currents, especially at the base or toe of a structure.

Sediment: Material in suspension in water or recently deposited from suspension; in the plural, all kinds of deposits from the waters of streams, lakes, or seas.

Sediment trapping: The capture of sediments behind structures such as dams and shoreline armoring, which restrict sediments from entering systems.

Shallows and flats: Areas from the 6-foot bathymetric contour line up to the edge of tidal marsh or swamp vegetation, or to mean higher high water where vegetation is absent.

Shoaling: A gradual decrease in water depth as the result of the accretion of sediments.

Smolts: Juvenile salmonids that have left their natal stream and are headed downriver toward the ocean.

Stream-type: Of or relating to salmonid juveniles that rear in freshwater for a year or more before entering the ocean.

Threat: A human action or natural event that causes or contributes to limiting factors; threats may be caused by past, present, or future actions or events.

Tidal marshes: Areas dominated by emergent vegetation and low shrubs; are typically found from mean lower low water to slightly above mean higher high water, although they are rare at the lowest elevations.

Tidal prism: The difference in the volume of water covering an area, such as a wetland, during low tide and the volume covering it during the subsequent high tide.

Tidal swamps: Shrub- and forest-dominated wetlands that extend up to the line of non-aquatic vegetation (the line at which excess water ceases to be a factor controlling the composition of the vegetation); tidal swamps may be of sufficiently high elevation that they are inundated only during spring tides, but they may also extend down below mean higher high water.

Tide: The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting on the rotating earth.

Turbidity: A condition in bodies of water where high sediment loads cause clouding of the water to varying extents; turbidity is an optical phenomenon and does not necessarily have a direct linear relationship to particulate concentration.

Viable salmonid population: An independent population of Pacific salmon or steelhead trout that has a negligible (generally ≤5 percent) risk of extinction over a 100-year timeframe.